with the optic vertex, and to the distance of this the focal adjustment is adapted.

Let α = optic angle, varied by means of the stereoscope.
,, α' = optic angle of normal vision for given distance.
,, D = distance of optic vertex from each eye, determined by the formula, $D = \frac{1}{2} i \operatorname{cosec} \frac{1}{2}\alpha$.
,, D′ = distance of radial point measured in the direction from which the reflected ray enters the eye. It is hence the distance of the vir ual image in normal vision.
,, A = distance of point of sight from binocular eye.

Under the conditions given above we have—

$\alpha = \alpha'$, and $A = D = D'$. Assume $D' = 50$ cm., then $\alpha' = 7° 20'$.

If now we make $\alpha = 37° 20'$, we have $D = 10$ cm. But to secure distinct vision, the focal adjustment must be adapted to D′, and therefore dissociated from the axial adjustment. This to some extent antagonises the effect of tension of the internal rectus muscles, and this antagonism is increased by the fact that the visual angle remains constant. The combined effect is that $A > D$ but $A < D'$. The apparent size of the image is diminished in the ratio of A to D′. The effect of increasing the optic angle is hence to make the image appear nearer, smaller, and less deep in proportion to its area, but more distant nevertheless than the new optic vertex.

If now we make $\alpha = -5°$, we have $D = -73{\cdot}4$ cm., but the relaxation of the internal rectus and contraction of the external rectus muscles causes the image to appear to recede in a positive direction. This illusion is opposed by the constancy of the visual angle, and the ciliary effort to keep the focal adjustment adapted to D′. The result is that $A > D'$, and the apparent size of the image is enlarged in the same ratio, while its depth is increased still more. The effect of making the optic angle negative is hence to cause the image to appear farther, larger, and deeper in proportion to its area.

If in the discussion just given we make α the angle between a pair of camera axes, and D the distance of its vertex, while i is the distance between the two lenses, the formula is readily applicable, but α can have only positive values. The optic angle for the observer while using the stereoscope is not necessarily, or even generally, the same as that between the camera axes when the picture was taken. Apparent distance in the stereoscope is thus not determined by the intersection of the observer's visual lines, and no mathematical formula can be made to apply to the interpretation of muscular tension in the muscles of the eyes. The error into which Wheatstone fell, and which was repeated and emphasised by Brewster, consists in the application of geometry where physiological conditions are such as to destroy the value of all geometric constructions. Unfortunately this error is still repeated in most of our text-books of physics, wherever diagrams are employed to explain the theory of the stereoscope.

W. Le Conte Stevens

New York

SCIENTIFIC SERIALS

The Quarterly Journal of Microscopical Science for April, 1882, contains—Pringsheim's researches on chlorophyll, translated and condensed by Professor Bayley Balfour (with plates 8 and 9).—Dr. D. H. Scott, on the development of articulated laticiferous vessels (plate 10). In the plants investigated, the vessels arose from rows of cells, of which the cross walls, and where two were in contact, the side walls in part became gradually absorbed. This took place very early; when not in contact, connection took place by means of cross rows of cells, which underwent fusion, or by inoculating outgrowths, before absorption; such cells showed the probable presence of latex.—Dr. E. Klein, on the lymphatic system and the minute structure of the salivary glands and pancreas (plates 11 and 12).—Prof. F. M. Balfour and F. Deighton, a renewed study of the germinal layers of the chick (plates 13–15).—Isao J. Iijima, on the origin and growth of the eggs and egg-strings in Nephelis, with some observations on the "spiral asters" (plates 16–19).—Dr. A. A. Hubrecht, a contribution to the morphology of the Amphineura.—Prof. E. Ray Lankester, on the chlorophyll-corpuscles and amyloid deposits of Spongilla and Hydra (plate 20). These forms are not of the nature of parasitic bodies, but they correspond in structure with the chlorophyll bodies in plants.

Journal of the Royal Microscopical Society for April, 1882, contains the President's address, by Prof. B. Martin Duncan.—On mounting objects in phosphorus, and in a solution of biniodide of mercury and iodi le of potassium, by J. W. Stephenson.—On the threads of spider webs, by Dr. J. Anthony.—With the usual most useful summary of current researches relating to geology and botany, and the Proceedings of the Society.

Journal of Anatomy and Physiology, Normal and Pathological, vol. xvi. Part 3, April, 1882, contains—Dr. A. M. Marshall, the segmental value of the cranial nerves (pl. 10).—Dr. G. E. Dobson, the anatomy of *Microgale longicauda*, with remarks on the homologies of the long flexors of the toes in mammalia.—Dr. T. P. A. Stuart, the curled hair and curled hair follicles of the Negro.—Dr. G. Sims Woodhead, some of the pathological conditions of the medulla oblongata, in a case of locomotor ataxia (pl. 11).—Dr. M. Hay, on the action of saline cathartics.—W. J. Walsham, abnormal origin and distribution of the upper seven right intercostal arteries, with remarks.—Dr. W. Stirling, on the digestion of blood by the common leech, and on the formation hæmoglobin crystals (pl. 12).—Prof. Turner, on a specimen of *Mesoplodon bidens*, captured in Shetland; and on a specimen of *Balænoptera borealis*, or *laticeps*, captured in the Firth of Forth.—G. S. Shattock, note on the anatomy of the Thyro-arytenoid muscle in the human larynx.

Johns Hopkins University. Studies from the Biological Laboratory, vol. ii. No. 2 (March, 1882), contains: W. K. Brooks, Medusæ found at Beaufort, N.C., during the summers of 1880 and 1881, and on the development of the ova in Salpa.—J. P. McMurrich, on—the origin of the so-called "test cells" in the Ascidian ovum.—G. M. Sternberg, bacterial organisms commonly found on exposed mucous surfaces and in the alimentary canal of healthy persons;—on a fatal form of Septicæmia in the rabbit from the subcutaneous injection of human saliva;—on experiments with disinfectants.—H. N. Martin, observations on the direct influence of variations of arterial pressure upon the rate of beat of the mammalian heart.—W. H. Howel and M. Warfield, the influences of changes of arterial pressure upon the pulse rate in the Frog and the Terrapin.—H. Garman and B. P. Colton, notes on the development of *Arbacia pustulata*.—K. Mitsukuri, on the structure and significance of some aberrant forms of lamellibranchiate gills.—E. B. Wilson, on the early developmental stages of some polychætous annelides.

The American Naturalist for April, 1882, contains—On mound pipes, by E. A. Barber.—On the flowers of *Solanum rostratum* and *Cassia chamœcrista*, by J. E. Todd.—Is Limulus an arachnid? by A. S. Packard; a criticism on the views of Prof. Lankester.—On a pathogenic Schizophyte of the hog, by H. J. Detmers.—On Mexican caves with human remains, by Ed. Palmer.—The Editor's table.—Recent literature.—General notes, and scientific news.

May, 1882, contains—The acorn-storing habits of the Californian woodpecker, by R. E. C. Stearns.—Observations on some American forms of *Chara coronata*, by T. F. Allen.—The löess of North America, by R. Ellsworth Call.—The ichthyological papers of G. P. Dunbar, with a sketch of his life by J. L. Wortman.—Problems for zoologists, by J. G. Kingsley.—Recent literature.—General Notes.—Scientific news.

Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, Bd. xxi. Heft 2, 1882, contains: Josef Mik, dipterological studies, II. (pl. xvi.), and notes on G. Strobl's discoveries of Diptera at Seitenstetten.—Ed. Ritter, on the Pselaphidæ and Scydmaenidæ of Syria; analytic key to the European Coleoptera, V. (pl. xix.).—C. R. Osten-Sacken, list of the entomological writings of Rondani (supplementary to Hagen).—J. Freyn, supplement to the flora of South Istria.—H. B. Möschler, contributions to the butterfly fauna of Surinam, IV. and end (pls. xvii. and xviii.).—A. Rogenhofer and Dr. R. W. v. Dalla Torre, on the Hymenoptera of Scopoli's "Entomologica Carniolica."—August Pelzeln, on the second package of birds sent by Dr. E. Bey from Central Africa.—Dr. L. W. Schaufuss, zoological results of an excursion to the Balearic Islands (pl. xxi.).—Dr. L. Koch, the Arachnida and Myriopoda of the Balearics (pl. xx. and xxi.).—Schulzer v. Müggenburg, mycological notes, VI.—L. Ganglbauer, analytic tables of European Coleoptera (pl. xxii.).—A. B. Meyer, on birds from some of the southern islands of the Malay Archipelago.—Johann Bubela, list of the wild plants of Bisenz in Moravia.

Archives des Sciences Physiques et Naturelles, April 15.—The grain of the glacier, by F. A. Forel.—Note on the extension of

a property of gases to liquids and to solids, by C. Cellèrier.—Recent changes in the appearances of Jupiter, by E. Gautier.

Atti della R. Accademia dei Lincei, vol. vi. fasc. 8.—Observations on the topography of the planet Mars, by G. Schiaparelli.—Communication on a geyser discovered at Montrond (Loire), by F. Lauri.—On the same subject, by F. Keller.—On the embryo of *Cuphea*, by G. Briosi.—Influence of different electric resistances on the dimensions of the excitative spark of condensers, by E. Villari.—On the dynamical value of a calorie, by G. Cantoni and G. Gerosa.—Oxidation of titanic acid, by A. Piccini.—Reports.

Morphologisches Jahrbuch. Eine Zeitschrift für Anatomie und Entwickelungsgeschichte, Bd 7, Heft iv., 1882, contains—Dr. Hans Virchow, on the lens and retinal vessels of the eel (pl. 27).—Dr. Sigbert Ganser, comparative anatomy studies of the brain of the mole, pp. 590, 725 (plates 28-32.—A most minute and painstaking account of the mole's brain), Dr. W. Pfitzner.—On nerve-endings in epithelium (pl. 33).

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, May 11.—S. Roberts, F.R.S., president, in the chair.—Mr. A. L. Daniels was elected a Member.—Dr. Hirst, F.R.S., communicated an account (similar to that he had given before the Royal Society in the afternoon of the same day) of a paper by M. Vanecek entitled "Sur l'Inversion générale."—The following further communications were made:—Elementary analytical proof of Graves's and MacCullagh's theorems, with an extension of the former, by J. Griffiths.—Note on a system of confocal bicircular quartics, by R. A. Roberts.—On the vibrations of an elastic sphere, by Prof. Lamb.—On a formula relating to elliptic integrals of the third kind, by Prof. Cayley, F.R.S.; and a short note by the president.

Physical Society, May 6.—Prof. Clifton, president, in the chair.—New Member, Mr. W. H. Heaton.—Mr. Lecky described a form of battery arranged by Mr. A. R. Bennet, of Glasgow, at a cost of 6*d.* per cell. The vessel and electro-negative plate consists of an iron meat or milk tin, into which is placed a porous pot containing a zinc plate stuck in a paraffined cork cover, fitting the porous pot. A solution of caustic soda is the liquid. In it iron does not rust, and is electro-negative to zinc. The electromotive force is 1·23 volts where the Daniel is taken as 1 volt and the Leclanché as 1·30 volts. Iron filings round the iron plate facilitate depolarisation by the escape of hydrogen from their points. The cell pitted against a Leclanché was found to ring an electric bell even longer than the latter.—Prof. Guthrie (in the absence of Dr. F. D. Brown, the author) gave a summary of a paper entitled "Notes on Thermometry." This described a method of calibrating the tubes by means of a microscope having an extra half-lens before the object-glass, which focussed the end of the mercury column, whilst the other lens focussed the tube, so that no alteration of the focus of the microscope was necessary in making an observation. Dr. Brown also found that a constant zero temperature was better obtained from a mixture of ice and water than from drained ice; and that it was preferable to mix the ice with distilled water rather than ordinary water. Acting on the suggestion of Dr. Guthrie, Dr. Whipple, of Kew, had found that the ice itself might be from different sources without appreciably affecting the result. Dr. Whipple called attention to the change of zero in thermometers by heating, and recommended buyers to see that makers had not let them be heated after their calibration. Mr. J. Macfarlane Gray suggested that the thermometers used by Regnault should be examined now, as our standards are based on his results. Prof. Clifton pointed out that the half-lens in the microscope would probably distort the image of the mercury column.—Prof. Guthrie then read a paper on the repulsion of a suspended horseshoe magnet by a rotating copper disc below it. He gave tables of quantitative results and a plotted curve, showing that the repulsion varied on the square of the rate of rotation. For a surface velocity of the disc of 163 metres per minute the repulsion was ·41 grammes.

Anthropological Institute, May 9, Major-General Pitt Rivers, F.R.S., president, in the chair.—The election of Mr. Henry Ling Roth was announced. Mr. G. M. Atkinson made some remarks upon a palæolithic implement found eighteen feet below the bed of the Thames at Chelsea, and exhibited by Mr. Lambton Young, C.E., and a jet ornament from Garvagh, co. Londonderry, exhibited by Mr. A. G. Geoghegan.—Mr. Worthington G. Smith exhibited a series of large palæolithic implements recently discovered.—Dr. Beddoe, F.R.S., read a paper on the evidence of surnames as to ethnological changes in England. The discussion was sustained by Messrs. Hyde Clarke, Holt, Park Harrison, Prideaux, Atkinson, C. Roberts and the chairman.—Mr. Park Harrison, M.A., read a paper on the survival of certain racial features in the population of the British Isles at the present day. Dr. Beddoe, Prof. Thane, Mr. Atkinson, and the president joined in the discussion.

Institution of Civil Engineers, May 9.—Sir Frederick Bramwell, vice-president, in the chair.—The paper read was on "Coal Washing," by Mr. Thos. F. Harvey, Assoc.M.Inst.C.E.

Royal Horticultural Society, May 9.—Sir J. D. Hooker in the chair.—*Larches attacked by Larvæ:* From a communication received by Sir J. D. Hooker it would appear that the trees mentioned in the last report had suffered much more extensively than was supposed, whole trees having been stripped of their foliage.—*Fungus in Dilute Sulphuric Acid:* Mr. W. G. Smith exhibited a specimen of the vinegar fungus, *Penicillium crustaceum*, growing in dilute sulphuric acid. Sir J. D. Hooker suggested it should be ascertained what nitrogenous substance was present in the acid, which alone could not support life.—*Proliferous Mushroom:* He also exhibited a specimen in which one pileus was inverted and adherent to the summit of another mushroom growing in the ordinary way.—*Foliage Injured by the Gale:* Dr. M. T. Masters exhibited leaves injured in various ways by the late severe gale, which by destroying the growing parts only revealed the different developmental orders of leaves. It appeared that salt spray had injured trees in some cases; but it was thought that the duration and great cold of the wind was more generally the cause of injury. Beeches, it was noticed, withstood it better than oaks.

Victoria (Philosophical) Institute.—A paper was read by Prof. Lionel S. Beale, F.R.S., on "Dictatorial and Scientific Utterances and the Decline of Thought." The author tried to show that the opinion now generally entertained by scientific men that the phenomena of the living world are due to the properties of the material particles is erroneous.

BERLIN

Physiological Society, May 5.—Prof. du Bois Reymond, president, in the chair.—Dr. J. Sander read a paper upon the distribution of the vaso-motor nerve-centres. In addition to the well-known centre of the vaso-motor nerves in the medulla-oblongata, several other centres in the spinal chord were determined by the experiments that were made. In the case of each of these centres the degree of stimulation was determined which produced the greatest effect, and beyond which no further excitation produced a rise in the blood-pressure. If this degree of maximum excitation was not reached, a cumulative effect was perceived by the simultaneous stimulation of two vaso-motor centres, and the weak excitation of two centres had always a much greater effect than that which would have been expected to result from the degree of stimulation. The increased blood-pressure that resulted from the stimulation of the centre lasted for a prolonged period, which proves that the smooth muscular tissue of the walls of the blood-vessels does not tire quickly.—In a previous meeting of the Society held on March 29, Dr. R. Koch had demonstrated his important discovery that tuberculosis is a parasitic disease, that its occurrence is connected with the presence of tubercle Bacillæ, which are always found in those tissues which had undergone tubercular change. The Bacillæ can be isolated and can be cultivated for long periods quite isolated; animals that were infected with the isolated bacteria by very different methods became, without exception, affected with tuberculosis. The important demonstration of these tubercle Bacillæ was accomplished by Dr. Koch by a staining method which consisted in the employment of an alkaline solution of methyl-blue and a watery Vesuvian solution (*Vesuvialösung*); under this treatment all tissues and cells became stained brown, while the tubercle Bacillæ alone became stained blue; by this means it was easy to demonstrate the tubercle Bacillæ in the excreta of consumptive patients, in which they regularly occur. This interesting relation of the tubercle-Bacillæ to the staining-fluids has been made the subject of investigation by Dr. Ehrlich, the principal results of which may be condensed into the statement that the cause of this extra-